

SUBJECT : Fuel System Drop-Test – Alternative Fluid

REQUIREMENTS incl. Amdt. : CS 27.952 CS 29.952 at Amdt. 1 through

ASSOCIATED IM/MoC : Yes / No

ADVISORY MATERIAL :

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INTRODUCTORY NOTE:

The following Equivalent Safety Finding (ESF) has been classified as important and as such is subject to public consultation in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) which states:

"2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency."

ABBREVIATIONS:

n/a

IDENTIFICATION OF ISSUE:

CS 27/29.952 (a) requires to drop test each tank, or the most critical tank, as following:

Unless other means acceptable to the Agency are employed to minimise the hazard of fuel fires to occupants following an otherwise survivable impact (crash landing), the fuel systems must incorporate the design features of this paragraph. These systems must be shown to be capable of sustaining the static and dynamic deceleration loads of this paragraph, considered as ultimate loads acting alone, measured at the system component's centre of gravity without structural damage to system components, fuel tanks, or their attachments that would leak fuel to an ignition source.

(a) Drop test requirements. Each tank, or the most critical tank, must be drop-tested as follows:

- (1) The drop height must be at least 15.2 m (50 ft).
- (2) The drop impact surface must be non-deforming.
- (3) The tank must be filled with water to 80% of the normal, full capacity.
- (4) The tank must be enclosed in a surrounding structure representative of the installation unless it can be established that the surrounding structure is free of projections or other design features likely to contribute to rupture of the tank.
- (5) The tank must drop freely and impact in a horizontal position $\pm 10^\circ$.
- (6) After the drop test there must be no leakage.

For some specific fuel system designs, filling the fuel system as required by CS 27/29.952 (a)(3) to 80% with water for each bladder tank would require a blockage of connector pipes between the bladder tanks. It is proposed that instead of filling each tank of the system to 80% with water to alternatively allow filling the tank system with an alternative drop test fluid of equivalent mass and relevant other characteristics. The alternative drop test fluid shall be similar to the approved fuel type in terms of density and viscosity, thus representative for the actual operation of the helicopter and for the fuel system crash test. The alternative drop test fluid shall be as safe as the normally required water in terms of handling characteristics and environmental considerations. The test article setup shall avoid local reinforcements like e.g. plugs in any connecting pipes that could stiffen the fuel system.

Considering all the above, the following Equivalent Safety Finding is proposed.

M-TS-0000378**Equivalent Safety Finding*****Fuel System Drop-Test – Alternative Drop Test Fluid*****1. APPLICABILITY**

This ESF is applicable to CS-27 and CS-29 rotorcraft with a conventional interconnected fuel system installed.

1.1 AFFECTED CS

CS 27.952 (a)(3), CS 29.952 (a)(3)

2. STATEMENT OF EQUIVALENT SAFETY FINDING

In lieu of direct compliance with the CS identified in chapter 1.1, and provided that the below compensating factors are complied with, the fuel tank must be filled to the normal, full capacity with a dyed alternative drop test fluid, representative of the approved fuel types in terms of its hydrostatic pressure, viscosity and density.

3. COMPENSATING FACTORS

- a) The alternative drop test fluid shall allow filling the fuel system without the need to clog or stiffen interconnections as to avoid undesired local reinforcements of the test article and thereby establish crashworthiness representativeness for the fuel system.
- b) The fluid characteristics shall be equivalently safe for handling and environmental aspects when compared to a test with water.
- c) The mass of the filled alternative drop test fluid shall be equal to an 80% filling with water of the normal, full capacity.
- d) The requirements of CS 27/29.952(a)(1), (2), (4), (5) and (6) remain unchanged and fully applicable.
- e) Beside the use of alternative fluid no further deviation of the drop test requirements shall be considered meaning same drop height, same overall weight (including fuel) in same representative and type-design conforming fuel system drop article